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Fertilizing Sunflowers

Sunflowers are adapted to a wide range of climates and soils across the United States and Canada. The sunflower plant has a deep taproot with profuse lateral branching, so this crop does better under low moisture and low fertility conditions than do many other crops in dryland areas. For maximum yields, however, soil nutrient levels must be adequate.

RESEARCH CONDUCTED

Oilseed sunflowers have been grown in fertilizer experiments at various locations in Minnesota, and relevant data are available from North Dakota.

Since 1978, members of the Department of Soil Science at the University of Minnesota have conducted fertilizer trials at the Becker Irrigation Farm on loamy sand soil. Nitrogen trials have been conducted by G. W. Randall, soil scientist at the Southern Experiment Station, Waseca, on fine textured soils and by S. D. Evans, soil scientist at the West Central Experiment Station, Morris, on silt loam soil. At or near the Northwest Experiment Station, Crookston, G. E. Varvel, soil scientist, has conducted nitrogen (N), phosphorus (P), and potassium (K) trials on both fine and coarse textured soils. In North Dakota, J. C. Zubriski, professor of soils at North Dakota State University, has conducted N, P, and K trials on various soil types. The results of the efforts of these researchers provided the basis for this general discussion on fertilizing oilseed sunflowers.

Nitrogen Needs

Response to nitrogen is considered likely for most crops if a sample from a 0- to 24-inch depth is less than 100 pounds per acre. With sunflower, however, few responses were observed when tests were above 70 pounds per acre. When nitrate tests were below 70 pounds, responses from 60 to 90 pounds per acre were common, but rates higher than 100 pounds were not necessary. In field trials, nitrogen rates up to 150 pounds per acre were used for several years and at numerous locations. The following data from the West Central Experiment Station at Morris represent one example and show the relationship between yield response and a nitrate-nitrogen test.

lb./A N	1978 lb./A	1979 seed
0	2,088	1,524
30	2,114	1,992
60	2,098	2,092
90	2,106	2,331
Significance	ns[1]	**[2]
B L S D (0.5)	—	180
Nitrate test		
0-2	72	31

[1] *No significant response.*
[2] *Highly significant response due to treatment.*

A nitrate test of 30 for a yield goal of 2,000 pounds per acre would warrant a 70-pounds-per-acre nitrogen recommendation.

Nitrogen generally decreased percentages of oil, but when there was a seed yield increase, total production of oil was increased. Plant analysis of the fifth leaf from the top at flowering time was related to a nitrogen response. Leaf N levels of 3.00 to 3.25 percent on fine textured soils and 3.75-4.00 percent on coarse textured soils were reached when N fertilization was adequate.

Phosphorus Needs

Sunflower yield increases from phosphorus treatments appear to occur only when phosphorus soil tests are medium or lower; that is, below 20 pounds per acre P by the Bray no. 1 extraction. Yield data indicating that increases occurred were often from treatments as low as 20 pounds per acre P_2O_5. Higher rates appeared unnecessary. The fifth leaf from the top should contain 0.3 percent P at flowering time as an indication of sufficient phosphorus.

Potassium Needs

Seed yield increases were obtained on soils with low K soil tests. These low tests are most frequent on sandy textured soils. When K soil tests were medium or higher, experiments showed that potassium responses were not likely. Frequently additions of 60 to 100 pounds per acre of K_2O were adequate on the low testing soils. In cases in which potassium additions benefit yield, oil percentage in the seed increases.

Plant analysis of the fifth leaf from the top showing 3 percent K would indicate a sufficient supply of potassium.

OTHER NUTRIENT REQUIREMENTS

Sulfur Needs

No sulfur trials have been conducted in Minnesota on sunflowers. Evidence from other states indicates that if leaf sulfur is below 0.5 percent, additions of sulfur fertilizer are advisable. Soil tests in the low range — below 7 parts per million (ppm) — would also indicate a sulfur need. Deficiency symptoms are pale green leaves and stunted growth. The most likely sulfur deficient areas are in north central Minnesota on coarse textured and low organic matter soils. Usually 20 pounds per acre of sulfur are sufficient on these soils; 10 pounds may be sufficient if it is applied near the row.

Magnesium Needs

Magnesium deficiencies could occur on acid soils or soils that have been limed with nonmagnesium materials such as marl or calcitic limestone. Where soils are acid, magnesium-containing dolomitic lime is recommended. Besides soil tests

for soil acidity, magnesium soil tests also are available. No data are available in Minnesota on yield increases from magnesium.

Boron Problems

Boron deficiencies are unlikely on sandy soils with low organic matter. Boron shortages will be most severe during dry weather because plants obtain much of their boron from decaying soil organic matter. When soils are dry, the decaying stops and the plant source of boron is curtailed. Boron deficiencies are unlikely on silt loam or finer textured soils.

Research from various parts of the world has indicated boron response on sandy soils. Plant analysis in trials on sandy soils in Minnesota showed more than 40 ppm boron in the fifth leaf from the top, which is quite high.

Ulrich and Hills, University of California, report that percentage of deformed heads is a good indicator of boron needs. They established that 10 percent deformed heads, considered a critical level, had about 30 ppm B. Where there is a known need for boron, 1 pound per acre broadcast is recommended.

SUMMARY

Sunflowers apparently can tolerate medium and higher fertility levels. In cases in which responses were obtained in field trials, additions of 60 pounds per acre of N and K_2O often corrected the deficiency; 20 pounds per acre of P_2O_5 were often adequate. Sunflowers will give a reasonable yield under low fertility and moisture conditions but will yield better when fertilization is adequate. Sunflowers are seldom grown more than once every four years on the same field, so fertilizer needs usually are dictated by the other crops.

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